



Chemical, rheological and sensory characteristics of wheat bread enriched with chia (*Salvia hispanica* L.) seed gum

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ABSTRACT

Bread is a staple food in many countries worldwide. The aim of this study is the presentation of a novel type of bread prepared of wheat flour and extract of chia seed gum (CSG). The CSG was included in the wheat flour mixture in a concentration from 2 to 10%. The flour mixture was characterized by its rheological properties through amylography, farinography, and extensography tests. The bread was also subjected to texture, color, and tactile analysis. The highest grades of the bread in terms of appearance, flavor, aroma, texture, and color were shown for flour mixture that contained 10% of CSG ($p < 0.05$); namely, this wheat mixture showed an improved value of volume, specific size, external and internal characteristics of bread.

1. Introduction

Chia (*Salvia hispanica* L.) is one of the herbal plants with serrated leaves and blue flowers. Chia seeds (CS) have been consumed by humans since ancient times, particularly by the Aztecs and Mayans in the Central American regions. However, they disappeared for a long period. In recent years, there has been a re-discovery of the nutritional benefits and health-promoting functions of chia seeds. (Knez Hrnčić et al., 2020, Din et al., 2021, Rahman et al., 2017). Namely, chia seeds are a great source of nutrients like proteins, oils, soluble fibers and many other bioactive compounds such as phenolic and antioxidants (Romankiewicz et al., 2017, Adamczyk et al., 2021). They have gained great interest from researchers due to (i) the increased global desire towards healthy lifestyles, and (ii) increasing incidences of chronic diseases associated with gluten-containing foods. The use of chia seeds has also been led by its health-promoting benefits in diseases such as high blood pressure, diabetes, and cholesterol due to its antioxidant properties (Din et al., 2021, Nduko et al., 2018, Oliva et al., 2021, Enes et al., 2020). The Food and Agriculture Organization (FAO) of the United Nations described chia seeds as an important source of polysaccharides by a relatively high

content of dietary fiber (38–40 g/100 g as they contain 3–6% gum, that can hold water 27 times of its weight (Khouri et al., 2023, Zięć et al., 2021, Eker & Karakaya, 2020). In the food industry, natural gums are preferable due to their biodegradability and biocompatibility with nontoxic impact on human health as well as lesser impact on the environment.

Chia gum extracted from chia seeds is a white powder, which when dissolved in water even at low concentrations forms a highly viscous solution - it is highly desirable as a stabilizer as a foam, emulsifier or binder in food and baked goods. Chia seed gum (CSG) has also been used as a replacement of eggs or oil in cakes, making it vegan and vegetarian friendly (Segura-Campos et al., 2014, Atik et al., 2020, Masood, 2022). In addition, gums can also be obtained easily from various sources and in large quantities for easy production and at low cost (Masood, 2022, Bhosale & Osmani, 2014, Goswami & Naik, 2014, Rani & Murthy, 2014, Karmakar, 2016). Moreover, gum has been used as an additive in the baking industry to modify rheological properties. For example, it improves the qualitative evaluation of bread by enhancing the structural properties of wheat dough with the addition of gum and improving the quality of baked goods. (Giaretta et al., 2018, Elhassaneen et al., 2014).

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